□41□ □□□□□□□□□□□

1□□□□□ $f(x)=\sin x-\ln(1+x)$□$f'(x)$□$f(x)$□□□□□□

□1□ $f'(x)$ □□□ $(-1,\frac{\pi}{2})$ □□□□□□□□□

□2□ $f(x)$ □□□ 2 □□□

□□□□□□□1□ $f(x)$ □□□□□ $(-1,+\infty)$□

$f'(x)=\cos x-\frac{1}{1+x}$□ $f''(x)=-\sin x+\frac{1}{(1+x)^2}$□

□ $g(x)=-\sin x+\frac{1}{(1+x)^2}$ □□ $g'(x)=-\cos x-\frac{2}{(1+x)^3}<0$ □ $(-1,\frac{\pi}{2})$ □□□□

$\therefore f''(x)$□ $(-1,\frac{\pi}{2})$ □□□□□□

□ $f''(0)=1$□ $f''(\frac{\pi}{2})=-1+\frac{1}{(1+\frac{\pi}{2})^2}<-1+1=0$ □□□□□□□□□□□

□□ $f''(x)$□ $(-1,\frac{\pi}{2})$ □□□□□□□□ x_0 □□□□□□□□□ $f'(x)$□ $(-1,x_0)$ □□□□□□

□ $(x_0$□ $\frac{\pi}{2})$ □□□□□□□□ $f'(x)$ □□□ $(-1,\frac{\pi}{2})$ □□□□□□□□□

□2□□□1□□□ $x\in(-1,0)$ □□ $f'(x)$ □□□□□ $f'(x)<f'(0)=0$□ $f(x)$ □□□□□

□ $x\in(0,x_0)$ □□ $f'(x)$ □□□□□ $f'(x)>f'(0)=0$□ $f(x)$ □□□□□

□□ $f'(x)$□ $(x_0$□ $\frac{\pi}{2})$ □□□□□□□ $f'(x_0)>0$□ $f'(\frac{\pi}{2})=-\frac{1}{1+\frac{\pi}{2}}<0$ □

□□□□□□□□□□□□ $f'(x)$□ $(x_0$□ $\frac{\pi}{2})$ □□□□□□□ x_1 □□□□□□□□□

□ $x\in(x_0$□ $x_1)$ □□ $f'(x)$ □□□□□ $f'(x)>f'(x_1)=0$□ $f(x)$ □□□□□

□ $x\in(x_1,\frac{\pi}{2})$ □□ $f'(x)$ □□□□□ $f'(x)<f'(x_1)=0$ □ $f(x)$ □□□□□

□ $x\in(\frac{\pi}{2}$ □ $\pi)$ □□ $\cos x<0$ □ $-\frac{1}{1+x}<0$ □□□ $f'(x)=\cos x-\frac{1}{1+x}<0$ □ $f(x)$ □□□□□

□□ $f(\frac{\pi}{2})=1-\ln(1+\frac{\pi}{2})>1-\ln(1+\frac{3.2}{2})=1-\ln 2.6>1-\ln e=0$ □

$f(\pi)=-\ln(1+\pi)<-\ln 3<0$ □

□□□□□□□

x	$(-1,0)$	0	$(0,x_1)$	x_1	$(x_1,\frac{\pi}{2})$	$\frac{\pi}{2}$	$(\frac{\pi}{2},\pi)$	π
$f'(x)$	-	0	+	0	-	-	-	-
$f(x)$	□□□□	0	□□□□	□□0	□□□□	□□0	□□□□	□□0

□□□□□□□□□□ $f(x)$ □ $(-1$ □ $\frac{\pi}{2}]$ □□□□□□□□□ 0□

□□□□□□□□□□□□□ $f(x)$ □ $(\frac{\pi}{2}$ □ $\pi)$ □□□□□□□□□ x_2 □

□ $x\in[\pi$ □ $+\infty)$ □□ $\sin x\leq 1<\ln(1+x)$ □□ $f(x)=\sin x-\ln(1+x)<0$ □□□□

□□□□ $f(x)$ □ $[\pi$ □ $+\infty)$ □□□□□

□□□ $f(x)$ □□□□ 2 □□□□

2□□□□□ $f(x)=\ln x-x+2\sin x$ □□□□

□1□ $f(x)$ □□□ $(0,\pi)$ □□□□□□□□□

□2□ $f(x)$ □□□□ 2 □□□□

□□□□□□□□1□□□ $f(x)=\ln x-x+2\sin x$ □ $x\in(0,\pi)$ □

$\therefore f'(x)=\frac{1}{x}-1+2\cos x$ □

□ $g(x)=\frac{1}{x}-1+2\cos x$ □ $x\in(0,\pi)$ □

$\therefore g'(x) = -\frac{1}{x^2} - 2\sin x < 0$ □∴□□ $g(x)$ □ $(0,\pi)$ □□□□□□

□□ □ $x \to 0$ □□ $g(x) \to +\infty$ □□ $g(\frac{\pi}{2}) = \frac{2}{\pi} - 1 < 0$ □

∴□□□□ $x_0 \in (0,\frac{\pi}{2})$ □□□ $g(x_0) = 0$ □

∴□ $x \in (0,x_0)$ □□ $g(x) > 0$ □□ $f'(x) > 0$ □□□ $f(x)$ □□□□□□ $x \in (x_0$ □ $\pi)$ □□ $g(x) < 0$ □□ $f'(x) < 0$ □□□ $f(x)$ □□□□□

∴□□ $f(x)$ □□□ $(0,\pi)$ □□□□□□□□ x_0 □

□2□□□1□□□□□□ $f(x)$ □ $(0,x_0)$ □□□□□□□ $(x_0$ □ $\pi)$ □□□□□□

∴ x_0 □□□ $f(x)$ □□□□□□□ $x_0 \in (0,\frac{\pi}{2})$ □

$\therefore f(x_0) > f(\frac{\pi}{2}) = ln\frac{\pi}{2} - \frac{\pi}{2} + 2 = ln\frac{\pi}{2} + \frac{4-\pi}{2} > 0$ □

□□ □ $x \to 0$ □□ $f(x) \to -\infty$ □ $f(\pi) = ln\pi - \pi < 0$ □

∴□□□ $(0,x_0)$ □□□□□□□□□□□ $(x_0$ □ $\pi)$ □□□□□□□□

□ $x \in (\pi,+\infty)$ □□□ $h(x) = lnx - x$ □□ $h'(x) = \frac{1}{x} - 1 = \frac{1-x}{x} < 0$ □

$\therefore h(x)$ □ $(\pi,+\infty)$ □□□□□□ $\therefore h(x) < h(\pi) = ln\pi - \pi < 0$ □

①□ $x \in (\pi,2\pi)$ □□ $\sin x < 0$ □∴□ $x \in (\pi,2\pi)$ □□ $f(x) < 0$ □□□□□

② $x \in (2\pi,+\infty)$ □□ $h(x) < h(2\pi) = ln(2\pi) - 2\pi < lne^2 - 2\pi < -2$ □□ $-2 \leqslant 2\sin x \leqslant 2$ □∴□ $x \in (2\pi,+\infty)$ □□ $f(x) < 0$ □□

□□□

∴□ $x \in (\pi,+\infty)$ □□ $f(x) = lnx - x + 2\sin x < 0$ □∴□□ $f(x)$ □□□ $(\pi,+\infty)$ □□□□□

∴□□ $f(x)$ □□□□2□□□□

3□□□□□ $f(x) = \sin x - e^{x-2}$ □□□□

□1□ $f(x)$ □□□ $(0,\frac{\pi}{2})$ □□□□□□□□□

□2□ $f(x)$ □ $(0,+\infty)$ □□□□□ 2 □□□□

□□□□□□1□□□ $f(x)=\sin x-e^{x-2}$ □□□ $f'(x)=\cos x-e^{x-2}$ □

□ $g(x)=f'(x)$ □□ $g'(x)=-\sin x-e^{x-2}$ □□□ $x\in(0,\frac{\pi}{2})$ □□ $g'(x)<0$ □□□ $g(x)$ □ $f'(x)$ □ $(0,\frac{\pi}{2})$ □□□□

□ $f'(0)=1-\frac{1}{e^2}>0,\ f'(\frac{\pi}{2})=-e^{\frac{\pi}{2}-2}<0$ □□ $f'(x)$ □□□□□□□ $f'(x)$ □ $(0,\frac{\pi}{2})$ □□□□□□ α □

□ $x\in(0,\alpha)$ □□ $f'(x)>0$ □□ $x\in(\alpha,\frac{\pi}{2})$ □□ $f'(x)<0$ □

□□ $f(x)$ □ $(0,\alpha)$ □□□□□ $(\alpha,\frac{\pi}{2})$ □□□□

□ $f(x)$ □ $(0,\frac{\pi}{2})$ □□□□□□□□□□

□2□□□ $f(x)=\sin x-e^{x-2}$ □□□ $f'(x)=\cos x-e^{x-2}$ □

□ $g(x)=f'(x)$ □□ $g'(x)=-\sin x-e^{x-2}$ □□□ $x\in(0,\pi)$ □□ $g'(x)<0$ □□□ $g(x)$ □ $(0,\pi)$ □□□□□□

□□1□□□ $f(x)$ □ $(0,\alpha)$ □□□□□ $(\alpha,\frac{\pi}{2})$ □□□□

□ $f(0)=-e^{-2}<0,\ f(\frac{\pi}{2})>0$ □□□ $f(\alpha)>f(\frac{\pi}{2})>0$ □

□ $f(x)$ □□□□□□□□□□□□□ $x_1\in(0,\alpha)$ □□□ $f(x_1)=0$ □

□ $x\in[\frac{\pi}{2},\pi]$ □□□ $f'(x)<0$ □ $f(x)$ □ $[\frac{\pi}{2},\pi]$ □□□□

□□□ $f(\pi)=-e^{\pi-2}<0,\ f(\frac{\pi}{2})>0$ □□ $f(x)$ □□□□□□□□

□□□□ $x_2\in(\frac{\pi}{2},\pi)$ □□□ $f(x_2)=0$ □

□ $x\in(\pi,+\infty)$ □□ $e^{x-2}>1$ □ $\sin x\leq 1$ □□□ $f(x)<0$ □□□ $f(x)$ □ $(\pi,+\infty)$ □□□□□□

□□□ $f(x)$ □□□□□□□□□

4□□□□□ $f(x)=\cos x+\frac{1}{4}x^2-1$

□1□□□□ $f(x)\leqslant 0$ □ $x\in[-\frac{\pi}{2},\frac{\pi}{2}]$

□2□□□ $y=f(x)$ □□□□□□□□□□□□□□

□□□□□□1□□□□□□ $f(x)=\cos x+\frac{1}{4}x^2+1$ □ $x\in[-\frac{\pi}{2}$ □ $\frac{\pi}{2}]$ □

□□ $f(x)$ □□□□□

□□□ $g(x)=\cos x+\frac{1}{4}x^2+1$ □ $x\in[0$ □ $\frac{\pi}{2}]$ □

□□ $g(x)=-\sin x+\frac{1}{2}x$ □ $x\in[-\frac{\pi}{2}$ □ $\frac{\pi}{2}]$ □

□□ $g'(x)=-\cos x+\frac{1}{2}$ □

□ $x\in[0$ □ $\frac{\pi}{3})$ □□ $g'(x)<0$ □□ $x\in(\frac{\pi}{3}$ □ $\frac{\pi}{2}]$ □□ $g'(x)<0$ □

□□□ $g(x)$ □ $[0$ □ $\frac{\pi}{3}]$ □□□□□□ $[\frac{\pi}{3}$ □ $\frac{\pi}{2}]$ □□□□□

□ $g(0)=0$ □ $g(\frac{\pi}{2})=\frac{\pi}{4}-1<0$ □

□□ $g(x)\leqslant 0$ □

□ $g(x)$ □ $[0$ □ $\frac{\pi}{2}]$ □□□□□

□ $g(x)_{max}=g(0)=0$ □

□ $g(x)\leqslant 0$ □

□□ $x\in[-\frac{\pi}{2}$ □ $\frac{\pi}{2}]$ □□ $f(x)\leqslant 0$ □

□2□①□□1□□□□ $x\in[0$ □ $\frac{\pi}{2}]$ □□□□ $f(x)$ □□□□ 1 □□□□ $x=0$ □

② □ $x\in[3$□$+\infty)$ □□ $f'(x)=-\sin x+\frac{1}{2}x..0$ □

□ $f(x)$ □$[3$□$+\infty)$ □□□□□

□ $f(x)..f$ □3□ $=\cos 3+\frac{5}{4}>0$ □

□□□ $y=f(x)$ □$[3$□$+\infty)$ □□□□

③ □ $x\in(\frac{\pi}{2}$□$3)$ □□

$f''(x)=-\cos x+\frac{1}{2}>0$ □

□□□ $f'(x)=-\sin x+\frac{1}{2}x$ □□□□□

□ $f'(\frac{\pi}{2})=\frac{\pi}{4}-1<0$ □ f' □3□>0□

□□□ x_0 □□ $f'(x_0)=0$ □

□□ $\frac{\pi}{2}<x<x_0$ □□ $f'(x)<0$ □□ $x_0<x<3$ □□ $f'(x)>0$ □

□□□ $f(x)$ □ $(\frac{\pi}{2}$ □ $x_0)$ □□□□□□ $(x_0$ □ $3)$ □□□□□

□ $f(\frac{\pi}{2})=\frac{\pi^2}{16}-1<0$ □ f □3□ $=\frac{5}{4}+\cos 3>0$ □

□□□ $f(x)$ □ $(\frac{\pi}{2}$ □ $3)$ □□ 1 □□□□

□□□ $y=f(x)$ □ R□□□□□

□□①②③□□□

□□□$[-3$□ $-\frac{\pi}{2})$ □ 1 □□□□□$(-\infty,-3)$ □□□□□ $[-\frac{\pi}{2}$ □ $0)$ □□□□

□□□ $f(x)$ □ R□□ 3 □□□□

5□□□□□ $f(x)=lnx-\sin x+ax(a>0)$ □

□1□□ $a=1$ □□□□ $x\in(1,\frac{\pi}{2})$ □□ $f(x)<2x-1$ □

□2□□ $f(x)$ □ $(0,2\pi)$ □□□□ 1 □□□□□ a □□□□□

□□□□□□1□□□□ $a=1$ □□ $f(x)=lnx-\sin x+x$ □□ $g(x)=f(x)-(2x-1)=lnx-\sin x-x+1$ □ $x\in(1,\frac{\pi}{2})$ □

□ $g(x)=\frac{1}{x}-\cos x-1=\frac{1-x}{x}-\cos x<0$ □ $\therefore g(x)$ □ $(1,\frac{\pi}{2})$ □□□□□

□ $g(x)<g$ □1□ $=-\sin 1<0$ □□□ $f(x)<2x-1$ □

□2□□□□□ $f'(x)=\frac{1}{x}-\cos x+a$ □ $x\in(0,2\pi)$ □ $a>0$ □

① □ $x\in(0$ □ $1]$ □□ $f'(x)\geqslant 1-\cos x+a>0$ □□□ $f(x)$ □□□□□□□□□□

② □ $x\in(1$ □ $\frac{\pi}{2}]$ □□□ $g(x)=f'(x)=\sin x-\frac{1}{x^2}$ □□ $g'(x)=\cos x+\frac{1}{x^2}>0$ □□□ $g(x)$ □□□□□□ g □1□ $=\sin 1-1<0$ □

$g(\frac{\pi}{2})=1-\frac{1}{(\frac{\pi}{2})^2}>0$ □$\therefore$□□□□ $x_0\in(1,\frac{\pi}{2})$ □□□ $g(x_0)=\sin x_0-\frac{1}{x_0^2}=0$ □□ $\sqrt{\sin x_0}=\frac{1}{x_0}$ □□ $x\in(1,x_0)$ □□ $g(x)<0$ □□

□

$f'(x)$ □□□□□□ $x\in(x_0$ □ $\frac{\pi}{2}]$ □□ $g(x)>0$ □□□ $f'(x)$ □□□□□□

$f'(x)_{min}=f'(x_0)=\frac{1}{x_0}-\cos x_0+a=\sqrt{\sin x_0}-\cos x_0+a>\sin x_0-\cos x_0>0$ □□ $f'(x)>0$ □□□ $f(x)$ □□□□□□□□□□

③ □ $x\in(\frac{\pi}{2}$ □ $\frac{3\pi}{2}]$ □□ $\cos x\leqslant 0$ □ $f'(x)=\frac{1}{x}-\cos x+a>0$ □□□ $f(x)$ □□□□□□□□□□

□□①②③□ $f(x)$ □ $(0$ □ $\frac{3\pi}{2}]$ □□□□□

□ $f(x)$ □ $(0,2\pi)$ □□□□ 1 □□□□$\therefore f(x)$ □□□ $(\frac{3\pi}{2}$ □ $2\pi)$ □□□□□□□

□ $f'(x)=0\Rightarrow\frac{1}{x}+a=\cos x$ □

∴□□ $y=\frac{1}{x}+a(a>0)$ □□□ $y=\cos x$ □ $x\in(\frac{3\pi}{2}$ □ $2\pi)$ □□□□□□□□□

∴ $\frac{1}{2\pi}+a<\cos 2\pi=1$ □□ $a<1-\frac{1}{2\pi}$ □

□□ a □□□□□□ $(0,1-\frac{1}{2\pi})$ □

6□□□□□ $f(x)=e^x-ax(a\in R)$ □

□1□□□□□ $f(x)$ □□□□□

□2□□ $a=2$ □□□□□ $g(x)=f(x)-\cos x$ □ $(-\frac{\pi}{2}$ □ $+\infty)$ □□□□□□□

□□□□□□1□ $f(x)=e^x-ax$ □□□□□□ R □ $f'(x)=e^x-a$ □

①□ $a\leqslant 0$ □□□□ $f'(x)>0$ □□□ $f(x)$ □ R □□□□□□

②□ $a>0$ □□□ $f'(x)>0$ □ $x>\ln a$ □□ $f'(x)<0$ □ $x<\ln a$ □

□□ $f(x)$ □ $(-\infty,\ln a)$ □□□□□□ $(\ln a,+\infty)$ □□□□□□

□□□□□□ $a\leqslant 0$ □□ $f(x)$ □ R □□□□□□□ $a>0$ □□ $f(x)$ □ $(-\infty,\ln a)$ □□□□□□ $(\ln a,+\infty)$ □□□□□□

□2□□ $a=2$ □□ $g(x)=e^x-2x-\cos x, x\in(-\frac{\pi}{2},+\infty)$ □ $g'(x)=e^x+\sin x-2$ □

①□ $x\in(-\frac{\pi}{2},0)$ □□□□ $g'(x)=(e^x-1)+(\sin x-1)<0$ □

□□ $g(x)$ □ $(-\frac{\pi}{2},0)$ □□□□□

□□ $g(x)>g(0)=0$ □

□□ $g(x)$ □ $(-\frac{\pi}{2},0)$ □□□□□

②□ $x\in[0,\frac{\pi}{2}]$ □□□□ $g'(x)$ □□□□□□ $g'(0)=-1<0, g'(\frac{\pi}{2})=e^{\frac{\pi}{2}}-1>0$ □

□□□□ $x_0\in(0,\frac{\pi}{2})$ □□ $g'(x_0)=0$ □

□ $x\in(0,x_0)$ □□ $g'(x)<0$ □□ $x\in(x_0,\frac{\pi}{2})$ □□ $g'(x)>0$ □

□□ $g(x)$ □ $[0$ □ $x_0)$ □□□□□□ $(x_0,\frac{\pi}{2}]$ □□□□□□ $g(0)=0$ □□□ $g(x_0)<0$ □

□□□ $g(\frac{\pi}{2})=e^{\frac{\pi}{2}}-\pi>0$ □□□ $g(x_0)\cdot g(\frac{\pi}{2})<0$ □

□□ $g(x)$ □ $(x_0,\frac{\pi}{2})$ □□□□□□□

□□ $g(x)$ □ $[0,\frac{\pi}{2}]$ □□□□□□

③ □ $x\in(\frac{\pi}{2},+\infty)$ □□ $g'(x)=e^x+\sin x-2>e^{\frac{\pi}{2}}-3>0$ □

□□ $g(x)$ □ $(\frac{\pi}{2},+\infty)$ □□□□□

□□ $g(\frac{\pi}{2})>0$ □□□ $g(x)$ □ $(\frac{\pi}{2},+\infty)$ □□□□

□□□□ $g(x)$ □ $(-\frac{\pi}{2},+\infty)$ □□□□□□ 2□

7□□1□□□□ $y=e^x-2\sin x-2x\cos x$ □□□ $(-\pi,-\frac{\pi}{2})$ □□□□□

□2□□□□ $f(x)=\frac{e^x}{x}-2\sin x$ □ $(-\pi,0)$ □□□□□□□□□ x_0 □□ $0<f(x_0)<2$ □

□□□□□□1□□□ $y'=e^x-2\cos x-2(\cos x-x\sin x)=e^x+2x\sin x-4\cos x$ □ $x\in(-\pi,-\frac{\pi}{2})$ □

□□ $e^x>0$ □ $2x\sin x>0$ □ $-4\cos x>0$ □□ $y'>0$ □

□□ y □□□□□□□

□2□□ $f'(x)=\frac{e^x(x-1)-2x^2\cos x}{x^2}$ □

□ $g(x)=e^x(x-1)-2x^2\cos x$ □ $g'(x)=x(e^x+2x\sin x-4\cos x)$

□ $x\in(-\pi,-\frac{\pi}{2})$ □□□1□□ $g'(x)<0$ □ $g(x)$ □□□

□ $g(-\frac{\pi}{2})=e^{-\frac{\pi}{2}}(-\frac{\pi}{2}-1)<0$ □ $g(-\pi)=8-e^{-\pi}(1+\pi)>0$ □

□□□□□□□□□□□□□□□□ $x_0\in(-\pi,-\frac{\pi}{2})$ □ $g(x_0)=0$ □

□ $x\in(-\pi,x_0)$ □□ $g(x)>0$ □ $f(x)$ □□□

□ $x\in(x_0$ □ $-\frac{\pi}{2})$ □□ $g(x)<0$ □ $f(x)$ □□□

□ $x\in(-\frac{\pi}{2}$ □ $0)$ □□ $f'(x)=\frac{e^x(x-1)}{x^2}-2\cos x<0$ □□□ $f(x)$ □□□

□ $f(x)$ □ $(x_0$ □ $0)$ □□□□□

□□ $f(x)$ □□□□□□□□ x_0 □

□ $f(x)$ □ $(x_0$ □ $-\frac{\pi}{2})$ □□□□ $f(x_0)>f(-\frac{\pi}{2})=\frac{e^{-\frac{\pi}{2}}}{-\frac{\pi}{2}}+2=-\frac{1}{\frac{\pi}{2}e^{\frac{\pi}{2}}}+2>0$ □

□ $f(x_0)=\frac{e^{x_0}}{x_0}-2\sin x_0$ □□ $x_0\in(-\pi,-\frac{\pi}{2})$ □□ $\frac{e^{x_0}}{x_0}\in(-1,0)$ □ $0<-2\sin x_0<2$ □

□ $f(x_0)<2$ □

□□□□□□□□

8□□□□□ $f(x)=\tan x-\sin x$□ $g(x)=x-\sin x$□ $x\in(0,\frac{\pi}{2})$ □

□1□□□□□ x□□□ $f(x)-g(x)=x$□ $(0,\frac{\pi}{2})$ □□□□□□□□□□□

□2□□ $x\in(0,\frac{\pi}{2})$ □□ $f(x) \geqslant ag(x)$ □□□□ a□□□□□

□□□□□□1□□□□□ $h(x)=f(x)-g(x)-x$□□ $h(x)=\tan x-2x$□

□□ $h'(x)=\frac{1}{\cos^2 x}-2=\frac{1-2\cos^2 x}{\cos^2 x}=\frac{(1+\sqrt{2}\cos x)(1-\sqrt{2}\cos x)}{\cos^2 x}$

□□□ $x\in(0,\frac{\pi}{4})$ □□ $\cos x>\frac{\sqrt{2}}{2}$ □ $h'(x)<0$□□ $x\in(\frac{\pi}{4},\frac{\pi}{2})$ □□ $h'(x)>0$□

□□ $h(x)=\tan x-2x$□ $x\in(0,\frac{\pi}{4})$ □□□□□□□ $x\in(\frac{\pi}{4},\frac{\pi}{2})$ □□□□□

□□□ $h(\frac{\pi}{4})<0, h(\frac{5\pi}{12})=\tan(\frac{5\pi}{12})-\frac{5\pi}{6}=2+\sqrt{3}-\frac{5\pi}{6}>2+1.7-2.5>0$

□□ $h(x)=\tan x-2x$□ $x\in(0,\frac{\pi}{4})$ □□□□□ $x\in(\frac{\pi}{4},\frac{\pi}{2})$ □□□□□□□

□□□□□□□□□□□

□2□□□□□□ $\varphi(x)=f(x)-ag(x)=\tan x-\sin x-a(x-\sin x)$□

□ $\varphi'(x)=\frac{1}{\cos^2 x}-\cos x-a(1-\cos x)=\frac{(1-\cos^3 x)}{\cos^2 x}-a(1-\cos x)$ □

① □ $a \leqslant 0$ □□□ $x\in(0,\frac{\pi}{2})$ □□ $\varphi'(x)>0$□

□□ $\varphi(x)$ □ $(0,\frac{\pi}{2})$ □□□□□□□ $\varphi(0)=0$□□□ $\varphi(x)>0$ □□□□

② □ $1<a \leqslant 3$ □□ $\varphi''(x)=\frac{2\sin x}{\cos^3 x}+\sin x-a\sin x=\sin x(\frac{2}{\cos^3 x}+1-a)$ □

□□ $x\in(0,\frac{\pi}{2})$ □□□ $\cos x\in(0,1)$ □□□ $\frac{2}{\cos^3 x}+1\in(3,+\infty)$

□□□ $1<a\leqslant 3$ □□ $\varphi''(x)>0$ □

□□□□ $\varphi'(x)$ □ $x\in(0,\frac{\pi}{2})$ □□□□□□ $\varphi'(0)=0$ □

□□ $\varphi'(x)>0$ □□□□□ $\varphi(x)$ □ $x\in(0,\frac{\pi}{2})$ □□□□□□ $\varphi(0)=0$ □ $\varphi(x)>0$ □ $x\in(0,\frac{\pi}{2})$ □□□

③□ $a>3$ □□ $\varphi''(x)=\sin x(\frac{2-(a-1)\cos^3 x}{\cos^3 x})=0$ □

□□ $\cos x=\sqrt[3]{\frac{2}{a-1}}\in(0,1)$ □□□□□□□ x_0 □

□□□ $x\in(0,x_0)$ □□ $\varphi''(x)<0$ □□ $x\in(x_0,\frac{\pi}{2})$ □□ $\varphi''(x)>0$

□□□ $x\in(0,x_0)$ □□ $\varphi'(x)$ □□□□□□ $x\in(x_0,\frac{\pi}{2})$ □□ $\varphi'(x)$ □□□□□

□ $\varphi'(0)=0$ □□□ $\varphi'(x)<0$ □ $x\in(0,x_0)$ □□□□

□□ $\varphi(x)$ □ $x\in(0,x_0)$ □□□□□□□ $\varphi(0)=0$ □□□ $\varphi(x_0)<0$ □□□□□□

□□ $a\leqslant 3$ □□□ a □□□□□3□

□□□□□ $\varphi(x)=f(x)-ag(x)=\tan x-\sin x-a(x-\sin x)$ □

□ $\varphi'(x)=\frac{1}{\cos^2 x}-\cos x-a(1-\cos x)=\frac{(1-\cos^3 x)}{\cos^2 x}-a(1-\cos x)$ □

□ $\varphi'(x)>0$ □□ $a<\frac{1+\cos x+\cos^2 x}{\cos^2 x}$ □

□ $g(x)=\frac{1+\cos x+\cos^2 x}{\cos^2 x}$ □ $x\in(0,\frac{\pi}{2})$ □

□ $\cos x=t$ □ $t\in(0,1)$ □

□ $g(t)=\frac{1+t+t^2}{t^2}=1+\frac{1}{t}+\frac{1}{t^2}=(\frac{1}{t}+\frac{1}{2})^2+\frac{3}{4}>0$ □

□□□ $\frac{1}{t}=-\frac{1}{2}$ □ $g(t)>3$ □

$\therefore$ □ $a\le 3$ □□ $\varphi'(x)>0$ □

□ $\varphi(x)$ □ $(0,\frac{\pi}{2})$ □□□□□□□ $\varphi(0)=0$ □

$\therefore \varphi(x)>0$ □□□□

□ a □□□□□ 3□

9□□□□□ $f(x)=\ln x+ax+\sin x$ □□□ $x\in(0$ □ $\pi]$ □

□1□□ $a=0$ □□□□□ $y=f(x)$ □□ $(\frac{\pi}{2}$ □ $f(\frac{\pi}{2}))$ □□□□□□□

□2□□□□□ $f(x)$ □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□3□□□□□ $f(x)$ □ $[\frac{\pi}{2}$ □ $\pi]$ □□□□□□□

□□□□□□□1□ $a=0$ □□ $f(x)=\ln x+\sin x$ □ $x\in(0$ □ $\pi]$ □

$f'(x)=\frac{1}{x}+\cos x$ □ $f(\frac{\pi}{2})=1+\ln\frac{\pi}{2}$ □ $f'(\frac{\pi}{2})=\frac{2}{\pi}$ □

□□□□□□□ $y=\frac{2}{\pi}x+\ln\frac{\pi}{2}$ □

□2□ $f'(x)=\frac{1}{x}+a+\cos x$ □

□ $g(x)=\frac{1}{x}+a+\cos x$ □ $g'(x)=-\frac{1}{x^2}-\sin x<0$ □

□ $f'(x)$ □□□ $f'(x)_{min}=f'(\pi)=\frac{1}{\pi}+a-1$ □

□ $x\to 0$ □□ $f'(x)\to +\infty$ □

① □ $f'(\pi)<0$ □□ $a<1-\frac{1}{\pi}$ □□ $\exists x_0\in(0,\pi)$ □ $f'(x_0)=0$ □

当 $x\in(0,x_0)$ 时，$f'(x)>0$，$f(x)$ 递增，

当 $x\in(x_0,\pi)$ 时，$f'(x)<0$，$f(x)$ 递减，

$\therefore f(x)$ 在 x_0 处取极大值，不存在极小值，

② 若 $f'(\pi)\geq 0$，即 $a\geq 1-\frac{1}{\pi}$，$f'(x)>0$，

$\therefore f(x)$ 在 $(0,\pi]$ 递增，此时 $f(x)$ 无极值，

(3) 由 (2) 可知：

(i) 若 $a\geq 1-\frac{1}{\pi}$ 时，由上问可知：

$f(x)_{min}=f(\frac{\pi}{2})\geq ln\frac{\pi}{2}+\frac{\pi}{2}(1-\frac{1}{\pi})+1=ln\frac{\pi}{2}+\frac{\pi}{2}+\frac{1}{2}>0$，

即 $a\geq 1-\frac{1}{\pi}$ 时函数没有零点，

(ii) 若 $a<1-\frac{1}{\pi}$ 时，$x\in(0,x_0]$ 时，$f(x)$ 递增，

$x\in(x_0,\pi]$ 时，$f(x)$ 递减，

由 $f'(x_0)=0$ 得 $\frac{1}{x_0}+a+\cos x_0=0$，从而 $a=-\frac{1}{x_0}-\cos x_0$，

再设 $h(x)=-\frac{1}{x}-\cos x$，则 $h'(x)=\frac{1}{x^2}+\sin x>0$ 从而 a 关于 x_0 递增，

① 若 $x_0\in(0,\frac{\pi}{2}]$，此时 $a\in(-\infty,-\frac{2}{\pi}]$，

若 $f(\frac{\pi}{2})f(\pi)>0$ 得 $a<-\frac{2}{\pi}(1+ln\frac{\pi}{2})$ 或 $a>-\frac{ln\pi}{\pi}$，

$\therefore a<-\frac{2}{\pi}(1+ln\frac{\pi}{2})$ 时无零点，

$f(\frac{\pi}{2})f(\pi)<0$ 得 $-\frac{2}{\pi}(1+ln\frac{\pi}{2})<a<-\frac{ln\pi}{\pi}$，

$\therefore -\frac{2}{\pi}(1+ln\frac{\pi}{2})<a\leq -\frac{2}{\pi}$ 时有 1 个零点，

□ $a=-\frac{2}{\pi}(1+ln\frac{\pi}{2})$ □□ $f(\frac{\pi}{2})=0$ □ $f(\pi)\neq 0$ □□1 □□□□

□□ $a<-\frac{2}{\pi}(1+ln\frac{\pi}{2})$ □□□□□ $-\frac{2}{\pi}(1+ln\frac{\pi}{2})\leqslant a\leqslant -\frac{2}{\pi}$ □□1 □□□□

② $x_0\in(\frac{\pi}{2}$ □ $\pi]$ □□□ $a\in(-\frac{2}{\pi}$ □ $1-\frac{1}{\pi}]$ □

$f(\frac{\pi}{2})=ln\frac{\pi}{2}+\frac{\pi}{2}a+1>0$ □ $f(\pi)=ln\pi+\pi a$ □

$\therefore f(x)_{max}=f(x_0)=lnx_0+ax_0+\sin x=lnx_0+\sin x_0-x_0\cos x_0-1$ □

□ $m(x)=lnx+\sin x-x\cos x-1$ □□ $m'(x)=\frac{1}{x}+x\sin x>0$ □

□ $f(x)_{max}>m(\frac{\pi}{2})=ln\frac{\pi}{2}>0$ □

□ $f(\pi)>0$ □ $a>-\frac{ln\pi}{\pi}$ □□ $-\frac{ln\pi}{\pi}<a<1-\frac{1}{\pi}$ □□□□□

□ $f(\pi)\leqslant 0$ □ $a\leqslant -\frac{ln\pi}{\pi}$ □□ $-\frac{2}{\pi}<a\leqslant -\frac{ln\pi}{\pi}$ □□1 □□□□

□□□ $a\in(-\infty$ □ $-\frac{2}{\pi}(1+ln\frac{\pi}{2})\cup(-\frac{ln\pi}{\pi}$ □ $+\infty)$ □□□□□

$a\in[-\frac{2}{\pi}(1+ln\frac{\pi}{2})$ □ $-\frac{ln\pi}{\pi}]$ □□1 □□□□

10□□□□□ $f(x)=(x-1)-(x+2)\sin x$ □

□1□□ $x\in[\frac{\pi}{2},\pi]$ □□□ $y=f(x)$ □□□□□

□2□□ $x\in[0$ □ $2\pi]$ □□□ $y=f(x)$ □□□□□□

□□□□□□1□□□□ $f(x)=(x-1)-(x+2)\sin x$ □ $x\in[\frac{\pi}{2},\pi]$ □

$f'(x)=1-\sin x-(x+2)\cos x$ □

□□ $\frac{\pi}{2}\leqslant x\leqslant\pi$ □ $\cos x\leqslant 0$ □□ $\sin x\leqslant 1$ □

$\therefore f'(x)\geqslant 0$ □ $f(x)$ □ $[\frac{\pi}{2}$ □ $\pi]$ □□□□□□

□ $f(\frac{\pi}{2})=-3<0$□$f(\pi)=\pi-1>0$□

$\therefore$□□$f(x)$□$[\frac{\pi}{2}$□$\pi]$□□□□□□

□2□□□□$f(x)=(x-1)-(x+2)\sin x$□$x\in[0$□$2\pi]$□

□$f'(x)=1-\sin x-(x+2)\cos x$□

□$h(x)=1-\sin x-(x+2)\cos x$□$h'(x)=-2\cos x+(x+2)\sin x$□

①□$0\leqslant x\leqslant\frac{\pi}{4}$□□ □ $\cos x\geqslant\frac{\sqrt{2}}{2}$□$1-2\cos x<1-2\times\frac{\sqrt{2}}{2}=1-\sqrt{2}<0$□

$\therefore f'(x)=1-\sin x-(x+2)\cos x=(1-2\cos x)-\sin x-x\cos x<0$□

$\therefore$□□$f(x)$□$[0$□$\frac{\pi}{4}]$□□□□□

②□$\frac{\pi}{4}<x<\pi$□□$h(\frac{\pi}{2})=0$□

□$\frac{\pi}{2}<x<\pi$□□ □ $\cos x<0$□$\therefore h'(x)=-2\cos x+(x+2)\sin x>0$□

$\therefore h(x)$□$[\frac{\pi}{2}$□$\pi]$□□□□$h(x)>h(\frac{\pi}{2})=0$□□$f'(x)>0$□

□$\frac{\pi}{4}<x<\frac{\pi}{2}$□□$\sin x>\cos x$□

$\therefore h'(x)=-2\cos x+(x+2)\sin x=2(\sin x-\cos x)+x\sin x>0$□

$\therefore h(x)$□$(\frac{\pi}{4}$□$\frac{\pi}{2})$□□□$h(x)<h(\frac{\pi}{2})=0$□$f'(x)<0$□

$\therefore\frac{\pi}{2}$□$f(x)$□$(\frac{\pi}{4}$□$\pi)$□□□□□□

③□$\pi<x\leqslant\frac{3\pi}{2}$□□$\sin x<0$□$\cos x\leqslant 0$□□$f'(x)>0$□$f(x)$□□□□□

④□$\frac{3\pi}{2}<x\leqslant 2\pi$□□$\cos x>0$□$\sin x<0$□

$\therefore h(x) = -2\cos x + (x+2)\sin x < 0$□

$\therefore h(x)$□$(\frac{3\pi}{2}$□$2\pi)$□□□□□ $h(\frac{3\pi}{2}) = 2 > 0$□$h(2\pi) = -2\pi - 1 < 0$□

$\therefore h(x)$□$(\frac{3\pi}{2}$□$2\pi)$□□□□□□ x_2□

□ $\frac{3\pi}{2} < x < x_2$ □□ $f'(x) > 0$□□ $x_2 < x < 2\pi$ □□ $f'(x) < 0$□

□ $x = x_2$□□□ $f(x)$□□□□□□□□

□□□□□ $f(x)$□□ 2 □□□□□

11□□□□□ $f(x) = (1-a-x)\sin x - (1+a+x)\cos x$□$x \in [0$□$\pi]$□$a \in R$□

□1□□□□ $f(x)$□$(\frac{\pi}{2}, f(\frac{\pi}{2}))$□□□□□□□ $\frac{\pi}{2}+1$ □□ a□□□

□2□□□□ $x \in [0$□$\pi]$□$f(x) \geqslant 0$□□□□□ a□□□□□□

□□□□□□1□ $f(x) = (1-a-x)\sin x - (1+a+x)\cos x$□

$\therefore f'(x) = (x+a)(\sin x - \cos x)$□

□□ $f(x)$□$(\frac{\pi}{2}, f(\frac{\pi}{2}))$□□□□□□□ $\frac{\pi}{2}+1$□

$\therefore f'(\frac{\pi}{2}) = \frac{\pi}{2} + a = \frac{\pi}{2} + 1$ □□□□ $a = 1$□

□2□□□1□□□ $f'(x) = (x+a)(\sin x - \cos x)$□$x \in [0$□$\pi]$□

□ $f'(x) = 0$□□□□ $x_1 = -a$□$x_2 = \frac{\pi}{4}$□

① □ $a \geqslant 0$□□ $x + a \geqslant 0$□□ $x \in [0$□$\frac{\pi}{4})$□□ $\sin x - \cos x < 0$□

□ $f'(x) \leqslant 0$□$f(x)$□□□

□ $x \in [\frac{\pi}{4}$□$\pi]$□□ $\sin x - \cos x \geqslant 0$□□ $f'(x) \geqslant 0$□$f(x)$□□□

□□□□ $x\in[0$□$\pi]$□ $f(x)\geqslant 0$□□□□

□□ $f(x)_{min}=f(\frac{\pi}{4})=\frac{\sqrt{2}}{2}(1-a-\frac{\pi}{4})-\frac{\sqrt{2}}{2}(1+a+\frac{\pi}{4})\geqslant 0$ □□□□ $a\leqslant -\frac{\pi}{4}$ □□□□□□

②□ $-\frac{\pi}{4}<a<0$ □□□ $x\in[0$□$-a)$□□ $x+a<0$□$\sin x-\cos x<0$□

□ $f'(x)>0$□ $f(x)$□□□

□ $x\in(-a,\frac{\pi}{4})$ □□ $x+a>0$□$\sin x-\cos x<0$□□ $f'(x)<0$□ $f(x)$□□□

□ $x\in(\frac{\pi}{4}$□$\pi]$□□ $x+a>0$□$\sin x-\cos x>0$□□ $f'(x)>0$□ $f(x)$□□□

□□□□ $x\in[0$□$\pi]$□ $f(x)\geqslant 0$□□□□□□ $\begin{cases} f(0)\geqslant 0 \\ f(\frac{\pi}{4})\geqslant 0 \end{cases}$ □□□□ $a\leqslant -1$□□□□□□

③□ $-\pi\leqslant a\leqslant -\frac{\pi}{4}$ □□□□②□□□ $f(x)$□$[0$□$\frac{\pi}{4})$ □□□□ $(\frac{\pi}{4}$□$-a)$□□□□ $(-a$□$\pi]$□□□

□□□□ $x\in[0$□$\pi]$□ $f(x)\geqslant 0$□□□□□□ $\begin{cases} f(0)\geqslant 0 \\ f(-a)\geqslant 0 \end{cases}$□□□□ $-\pi\leqslant a\leqslant -1$□□ $a\in[-\pi$□$-1]$□□□□□□

④□ $a<-\pi$ □□ $f(x)$□$[0$□$\frac{\pi}{4})$ □□□□ $(\frac{\pi}{4}$□$\pi]$□□□

□□□□ $x\in[0$□$\pi]$□ $f(x)\geqslant 0$□□□□□□ $\begin{cases} f(\pi)\geqslant 0 \\ f(0)\geqslant 0 \end{cases}$ □□□□ $-\pi-1\leqslant a\leqslant -1$□

□ $a\in[-\pi-1$□$-\pi]$□□□□□□

□□□ $a\in[-\pi-1$□$-1]$□